SECTION 5

MCNARY DAM

McNary Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the general site plan for McNary Lock and Dam (Figure MCN-1). Dates of project operations for fish purposes and special operations are listed in Table MCN-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The juvenile facilities at McNary Dam consist of extended-length submersible bar screens (ESBS) with flow vanes, vertical barrier screens, gatewell orifices, a concrete collection channel with emergency bypass outlets, primary and secondary dewatering structures, a pipeline/corrugated metal flume for transporting juvenile fish to the transportation facilities or bypassing them back to the river, and a full-flow PIT tag detection system. Juvenile transportation facilities at McNary include: a separator to sort juvenile fish by size and to separate them from adult fish; a flume system for distributing fish among the raceways; covered raceways for holding fish; sampling facilities; an office and sampling building with fish marking facilities; barge and truck loading facilities; and PIT tag detection and deflection systems.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at McNary Dam is indicated in Table MCN-2. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities, which may impact juvenile fish passage or facility operations, should be conducted during the maintenance season.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at McNary consist of separate north and south shore facilities. The north shore facilities are made up of a fish ladder with counting station, submerged orifice PIT tag antennas in the ladder, a small collection system, and a gravity-flow auxiliary water supply system. The gravity-flow auxiliary water supply system has a turbine unit installed on it, operated by North Wasco County PUD. The gravity-flow auxiliary water supply system takes water from the forebay through 2 conduits, passes the water through a turbine unit or through a bypass/energy dissipater when the turbine unit is not in operation, and distributes the water through a diffuser system at the bottom of the ladder and in the transportation channel. The north shore collection system has three downstream entrances and a side entrance into the spillway basin. Two of the downstream

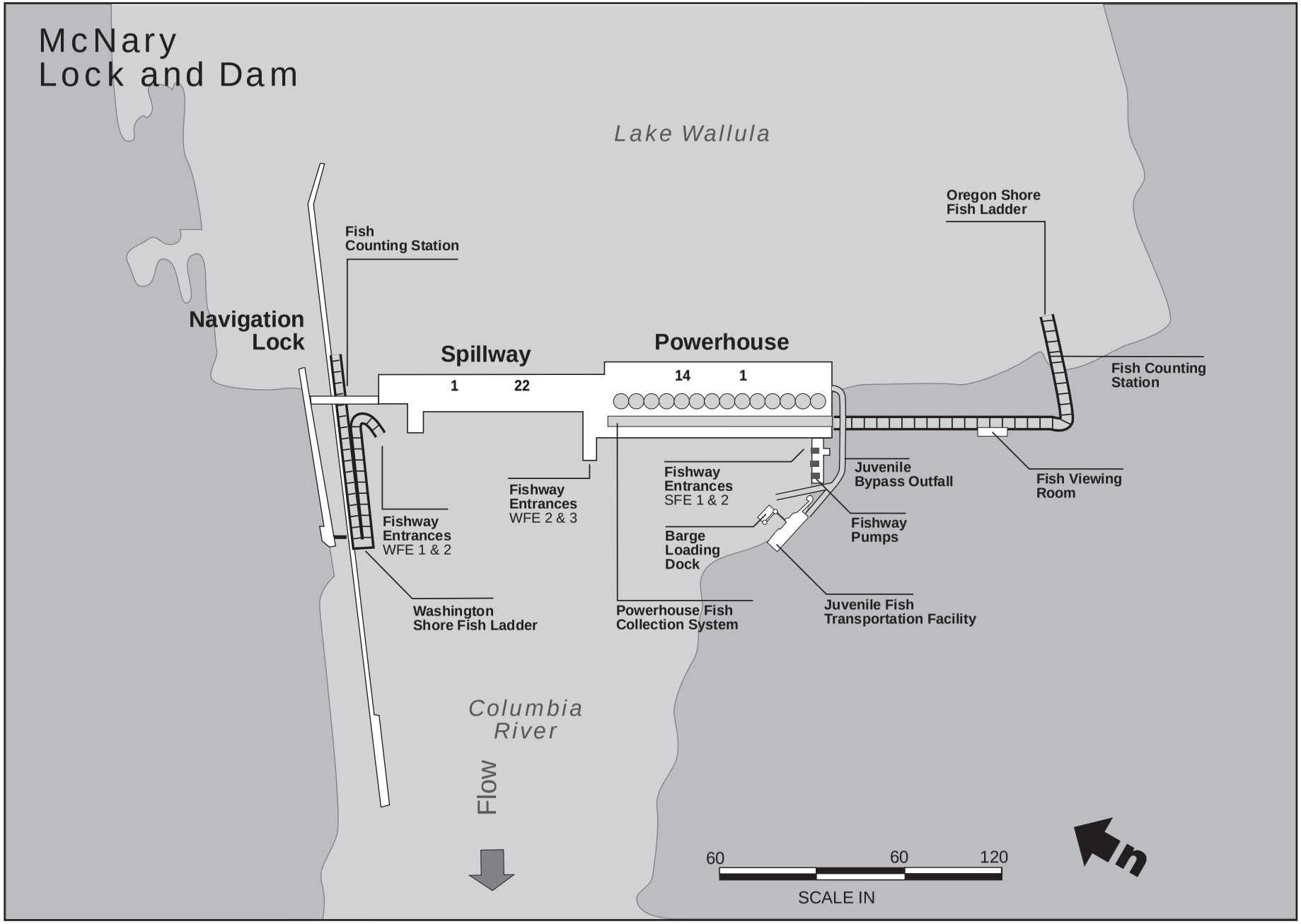

Figure MCN-1 McNary Lock and Dam general site plan.

Table MCN-1. Dates of project operations for fish purposes at McNary Dam, 2003

Task Name	Start	Finish	FPP Reference
TDG Monitoring	3/1/03	2/29/04	App D Phase 2
Maintenance of Juvenile Facilities	3/1/03	3/31/03	Mcn 2.3.1.1
Adult Passage Period	3/1/03	12/31/03	Mcn 2.3.2.2
Weekly Reports	3/1/03	12/31/03	Mcn 2.3.3
Operate Turbines for Fish Passage	3/1/03	11/30/03	Mcn 4.1
1% limitations	**3/1/03**	**2/29/04**	**Mcn 4.1**
1% Soft	3/1/03	3/14/03	Mcn 4.1
1% Hard	3/15/03	10/31/03	Mcn 4.1
1% Soft	11/1/03	2/29/04	Mcn 4.1
Adult Migration Study	3/1/03	12/31/03	App A Mcn 2.2
Steelhead Kelt Migration Study	3/1/03	12/31/03	App A Mcn 2.3
Final Report	3/15/03	3/15/03	Mcn 2.3.3
Backflush orifices once per shift	4/1/03	8/15/03	Mcn 2.3.1.2.c.6
Adult Fish Counting (Visual 0400 - 2000) pst	4/1/03	10/31/03	Mcn 1.2.2
Operate Juvenile Facilities	4/1/03	12/15/03	Mcn 2.3.1
Ihr Spillway Survival Study	4/3/03	8/31/03	App A Mcn 2.4
Spill for Juvenile Fish	4/10/03	6/30/03	Mcn 2.1
Cylindrical Dewatering Screen Testing	4/10/03	6/30/03	App A Mcn 2.7
Doble Testing	**4/14/03**	**10/9/03**	**App A Mcn 1.3**
Doble Testing T2 Units 3, 4	4/14/03	4/24/03	App A Mcn 1.3
Doble Testing T3 Units 5, 6	8/25/03	9/11/03	App A Mcn 1.3
Doble Testing T5 Units 9, 10	9/22/03	10/9/03	App A Mcn 1.3
Water Temperature Measurement	6/15/03	8/31/03	App B 4.f(3)
Juvenile Fish Transportation	6/20/03	9/30/03	App B 3
Transport vs. In-river Survival	6/20/03	9/30/03	App A Mcn 2.1
Turbines - Gates in Standard Position	8/1/03	12/15/03	Mcn 4.2
Maintenance of Juvenile Facilities	12/16/03	2/29/04	Mcn 2.3.1.1
Maint of Upstream Passage Facilities	1/1/04	2/29/04	Mcn 1.2.2
Draft Final Report	2/10/04	2/10/04	Mcn 2.3.3

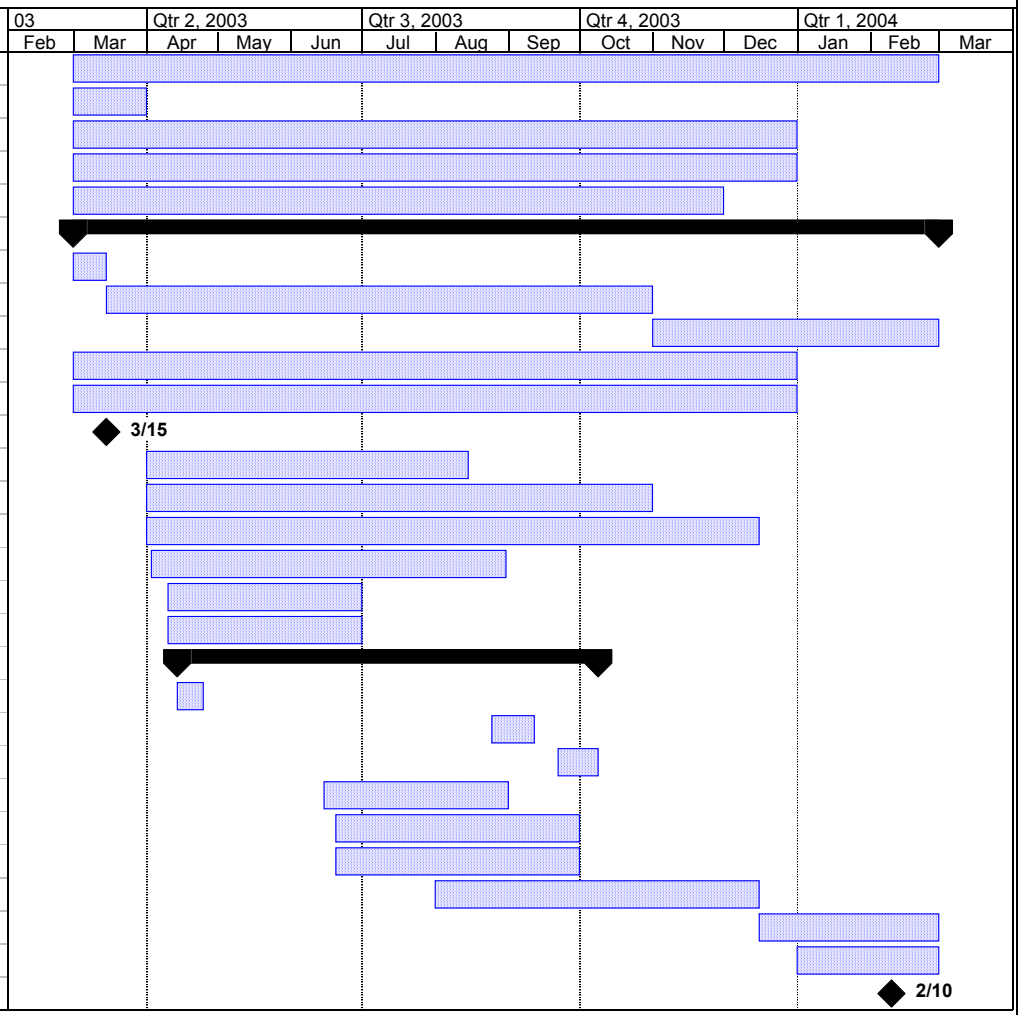

Table MCN-2. Juvenile migration timing at McNary Dam based on juvenile fish collection numbers.

% Collection	1998	1999	2000	2001	2002
Yearling Chinook					
10%	4/10	4/14	4/28	5/11	5/2
90%	5/24	5/26	6/2	6/7	5/26
Subyearling Chinook					
10%	6/20	6/18	6/22	6/20	6/22
90%	7/22	8/10	8/1	7/28	8/12
Hatchery Steelhead					
10%	4/20	4/10	4/11	4/26	4/21
90%	5/27	6/1	6/7	6/9	6/4
Wild Steelhead					
10%	4/18	4/22	4/20	5/4	4/24
90%	5/29	5/31	6/2	6/13	6/2
Sockeye					
10%	5/4	5/6	4/29	5/27	5/4
90%	5/23	5/27	8/1	6/9	5/25

entrances are used during normal operation. The south shore facilities are comprised of a fish ladder with counting station, submerged orifice PIT tag antennas in the ladder and experimental antennas at the counting station, two south shore entrances, a powerhouse collection system, and gravity and pumped auxiliary water supply systems. The powerhouse collection system contains three downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, twelve operating floating orifices, and a common transportation channel. At the north end of the powerhouse, two of the downstream entrances are used during normal operation with the other downstream and side entrances closed. The gravity-flow auxiliary water is provided by one conduit from the forebay and supplies the diffusers at the bottom of the ladder at tailwater level. The pumped auxiliary water is supplied by three electric pumps with variable-pitched blades. Two pumps are capable of providing the required flow when the third pump is bulkheaded to prevent water from flowing back through the pump to the river. The electric pumps supply the auxiliary water for the diffusers at the entrances and in the transportation channel. Excess water from the primary dewatering structure in the juvenile fish collection channel is routed to the adult collection system at the north end of the powerhouse.

1.2.2. Adult Migration Timing. Upstream migrants are present at McNary Dam all year. Maintenance of upstream passage facilities is scheduled for January and February to minimize impacts on

adult migrants. Table MCN-3 shows primary passage periods by species and the earliest and latest dates of peak passage on record from fish count data compiled by the Corps of Engineers. Adult fish (salmon, steelhead, bull trout, and lamprey) are normally counted 16 hours per day (0400 through 2000 hours Pacific Standard Time) from April 1 through October 31. Additional 16 hour per day counting will take place during March, November, and December 2003 for gathering data for setting non-routine maintenance schedules.

Table MCN-3. Adult migration timing at McNary Dam based on fish counts, 1954-2001.

Species	Count Period	Date of Peak Passage	
		Earliest	Latest
Spring chinook	4/1-6/8	4/20	5/26
Summer chinook	6/9-8/8	6/17	7/26
Fall chinook	8/9-10/31	9/10	9/25
Steelhead	4/1-10/31	7/9	10/13
Coho	4/1-10/31	9/5	10/11
Sockeye	4/1-10/31	6/23	7/16

2. Project Operation.

2.1. Spill Management. Involuntary spill at McNary is the result of river flow exceeding powerhouse capacity, insufficient generation loads to pass the river flow, turbine unit outages (forced or scheduled), or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at McNary shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section in Table MCN-5. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research). Special spills for juvenile fish passage normally occur during the spring, from approximately April 10 through late June, when the project is bypassing collected fish. Spill may continue after this date in accordance with Appendix A or if river flow is above powerhouse capacity. If possible, when powerhouse generation load/spill changes greater then 50,000 cfs are made, they should be ramped over a one-hour period to minimize rapid flow changes in the juvenile fish collection channel.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at McNary are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels are monitored at two locations in the McNary forebay: at the

navigation lock on the north shore, to monitor the mid-Columbia arm of the McNary pool, and on the south end of the powerhouse, to monitor Snake River inflow. The TDG levels will also be monitored in the McNary tailrace. The TDG will be recorded every half-hour and reported hourly via computer year-round. Related data collected at the same time for McNary Project include spill volume and total project flow. Implementation of spill requests at McNary will be based in part upon TDG monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migrant monitoring data. Spill requests will be coordinated through the Technical Management Team (TMT).

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish bypass, collection, and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate according to the criteria listed below and in Appendix B (Corps' Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids. The transportation program may be revised in accordance with the ESA Section 10 permit and the NMFS biological opinion.

2.3.1.1. Winter Maintenance Period (December 16 through March 31). Check and maintain as needed the items listed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay and trash racks.

2. Rake trash racks.

3. Remove debris from gatewell slots.

4. Measure and log drawdown in gatewell slots.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Maintenance completed on all ESBSs.

2. Inspect ESBSs for good running order and operate debris cleaner one trial run (dogged off at deck level).

3. Inspect flow vanes to make sure they are in good condition and all surfaces are smooth. Repair as needed.

4. Inspect all VBSs at least once per year by either raising the VBS and visually inspecting or inspecting with an underwater video camera.

c. Collection Channel.

1. Orifice lights are operational.

2. Orifices are clean and valves operate correctly.

3. Orifice air back flush system works correctly.

4. Netting over handrails and orifice chutes maintained and in good condition. Repair or replace as needed.

5. Plastic covers on orifice chutes maintained and in good condition and clean so orifice flow is visible.

d. Dewatering Structure and Flume.

1. Inclined and side dewatering screens are clean and in good condition with no gaps between screen panels, no damaged panels, and no missing silicone.

2. Cleaning brush systems are maintained and operating correctly.

3. All valves in good condition and operating correctly.

4. Stilling well water level sensing device inspected and operable.

5. Flume and pipe interiors smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate is maintained and operational.

2. Flume is smooth with no rough edges.

3. Perforated plate and bar screen edges are smooth with no rough edges.

4. Wet separator and fish distribution system maintained and operating as designed.

5. Brushes on all crowders in good condition or new.

6. Crowders maintained and operating properly.

7. All valves, slide gates, and switch gates maintained and operating correctly.

8. Raceway and tank retainer screens set in place with no holes or sharp wires protruding.

9. Barge and truck loading pipes are free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling equipment should be maintained and operating correctly.

f. Avian Predation Areas (Forebay and Tailrace). Inspect bird wires, water cannon, and other deterrent devices and repair or replace as needed. Where possible, install additional bird wires or other deterrent devices to cover areas of known avian predation activity.

g. Fish Transport Trailers.

1. All systems are maintained, including refrigeration system, and operating properly.

2. No leaks around air stone fittings; repair where necessary.

3. Plugs should be placed in end of air stones.

4. Turn air stones on lathe if necessary to allow free air passage through stones.

5. Each trailer should carry two hoses of the right size with the necessary cam lock caps.

6. All air and water valves should operate correctly.

7. Overall condition of trailer should be maintained and in good condition including hatch covers, release gates, and oxygen manifold system.

h. Maintenance Records. Record all maintenance and inspections.

2.3.1.2. Fish Passage Period (April 1 through December 15). Operate facilities as detailed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice or results from fish sampling give indications that an orifice may be partially obstructed with debris, the orifice(s) will be closed and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris, the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot removed within 24 hours, the gatewell orifices shall be closed immediately and the turbine unit shut down within one hour until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

4. Remove debris from forebay and trashracks as required to minimize impacts on fish condition. Additional raking may be required when heavy debris loads are present in the river. Fish quality will also be an indicator of debris buildup on the trash racks. Project biologist shall determine when additional trash raking is required

5. Coordinate cleaning efforts with personnel operating juvenile collection facilities.

6. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Operate ESBSs with flow vanes attached to screen.

2. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency as required to maintain good fish condition, with initial settings of every 15 minutes. Increase cleaning frequency if needed to maintain clean screens.

3. Inspect ESBSs in at least 3 operating turbine units per week by means of underwater video. Spot-check VBSs at the same time.

4. Conduct additional ESBS inspections if fish condition warrants it.

5. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, or VBS. Turbine units shall not operate for more than 10 hours, *and preferably less than 3 hours*, with ESBSs in place and orifices closed. Orifice closure time should be minimized by efficient planning and completion of the work to be done (e.g. having equipment, materials, and personnel ready before orifices are closed).

6. Make formal determination at end of season as to adequacy of bar screen panels and debris cleaner brushes and replace components as necessary.

7. Measure head differentials across VBSs daily during times of debris. Clean VBS when head differentials reach 1.5'. When a head differential of 1.5' is reached, the respective turbine unit should be operated at a reduced generation loading if the VBSs can not be cleaned within 8 hours, to minimize loading on the VBS and potential fish impingement.

8. Inspect at least 4 VBSs in 2 different turbine units between the spring and summer migration periods. Both turbine units should have been operated frequently during the spring. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

9. Inspect all vertical barrier screens at least once per year and whenever pulled for cleaning. Repair as needed.

c. Collection Gallery.

1. Operate at least one orifice per gate slot (preferably the south orifice). If orifices must be closed to repair any part of the facility, do not close orifices in operating turbine units with ESBSs in place for longer than 10 hours. If possible, orifice closures should be limited to less than 3 hours. During periods of high fish numbers or high debris, this time period may be less. Monitor fish condition in gatewells hourly during orifice closure.

2. Orifices are clean of debris and operating correctly.

3. Orifice lights are operating on open orifices.

4. Orifice jets are hitting no closer than 3' from wall (bypass gallery full).

5. Orifice valves are either full open or closed.

6. Backflush orifices at least once per day. During periods of high fish and debris passage, April 1 through August 15, orifices should be inspected and backflushed twice daily or more frequently as determined by the project biologist, to keep orifices clean.

d. Dewatering Structure.

1. No gaps between panels or missing silicone in side and inclined screens.

2. Trash sweeps operating correctly.

3. The project biologist shall determine the frequency of operation of the trash sweeps. The sweeps should operate at a frequency to maintain a clean screen given present debris loads. Frequency of operation may vary from as low as once every 15 minutes to once every 2 or more hours.

4. If automated cleaning system problems occur, project personnel shall operate cleaners at least once per shift unless determined differently by the project biologist.

5. The dewatering structure may be dewatered twice during the season, during low fish passage periods in June and September, for inspection and cleaning of the dewatering screens. Before dewatering occurs, the project biologist must notify

CENWW-OD-TN who in turn will coordinate the proposed action with the NMFS and FPC.

e. Transportation Facilities.

1. There should be no holes or gaps between screen panels. All silicone sealer should be in good condition.

2. Crowder screen brushes should be in good operating condition.

3. Assure that retainer screens in raceways and tanks are clean with no holes or protruding wires.

4. Operate wet separator and fish distribution system as designed.

5. Project personnel shall release ice blocks through each 10-inch bypass line, one to three times per day as warranted by woody debris loads, during the spring as a preventative measure for debris plugging. Additional ice blocks shall be passed down the pipelines during high debris periods as needed to keep the pipes debris free. Releasing ice blocks through the pipes should continue during the summer when transporting fish, as determined by the project biologist to keep the pipelines debris free.

6. Truck and barge loading facilities should be kept in good operating condition.

f. Avian Predation Areas (Forebay and Tailrace).

1. Bird wires and other avian deterrent devices should be monitored to assure they are in good condition. Any broken wires or devices should be replaced as soon as possible.

2. Harassment program in place to deter avian predation in areas actively used by birds and not covered by bird wires or other devices.

3. Project biologists shall routinely monitor project areas to determine areas of active avian predation and, if possible, adjust harassment program to cover these areas or install bird wires or other deterrent devices to discourage avian predation activities.

g. Facility Inspections. Inspect all facilities according to fish facilities monitoring plan. Record all inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities as described below.

2.3.2.1. Winter Maintenance Period (January 1 through February 28).

a. Inspect all staff gauges and water level indicators: repair and/or clean where necessary.

b. Dewater all ladders and inspect all sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Fish ladder exit trashracks must have smooth surfaces where fish pass, and must have downstream edges that are adequately rounded or padded. Inspect all diffuser gratings and chambers annually by dewatering and physically inspecting the gratings and chambers or by using divers or video inspection techniques. Once collection channel stoplogs are replaced, all diffuser gratings and chambers are to be dewatered and physically inspected at least every 3 years. Repair deficiencies.

c. Prior to the fish passage period, inspect for and clean debris from the fish ladder exits. All trashracks and picketed leads must be clean and installed correctly.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

e. Inspect all spill gates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31).

a. Fishway Ladders. Water depth over weirs: 1' to 1.3'.

b. Counting Window Widths. Counting windows should be operated as far out as possible (minimum of 18") while maintaining adequate counting conditions.

c. Head on all Entrances. Head range: 1' to 2'.

d. Collection Channel Transportation Velocity. 1.5' to 4' per second.

e. North Shore Entrances (WFE 1 & 2).

1. Operate 2 downstream gates (Controlled by North Wasco County PUD)

2. Weir depth: 8' or greater below tailwater.

f. North Powerhouse Entrances (NFE 2 & 3).

1. Operate 2 downstream gates.

2. Weir depth: 9' or greater below tailwater.

g. Powerhouse Collection System Floating Orifices. Operate 12 floating orifices (O.G. numbers 1, 3, 4, 8, 14, 21, 26, 32, 37, 41, 43, and 44).

h. South Shore Entrances (SFE 1 & 2).

1. Operate 2 entrances.

2. Weir depth: 9' or greater below tailwater.

i. Head on Trashracks.

1. Maximum head of 0.5' on ladder exits.

2. Maximum head on picketed leads shall be 0.5'. Normal head differential on clean leads is 0.3'.

3. Trashracks and picketed leads installed correctly.

j. Staff Gauges and Water Level Indicators. Shall be readable at all water levels encountered during the fish passage period.

k. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day shift and check computer monitor information at least once during each back shift.

2. Project biologists shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Picketed leads shall be inspected during all inspections to ensure they are clean and in the correct position (all the way down).

4. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within

calibration. This may be done as part of routine fishway inspections.

5. Inspect fishways daily for foreign substances, (particularly oil). If substances are found, corrective actions should be undertaken immediately.

6. Record all inspections.

2.3.3. Facility monitoring and reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities that occurred at the project that may affect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENWW-OD-TN by noon the following Monday via electronic mail. Project biologists shall prepare a draft annual report by February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. The annual report shall also include a description of all actions taken to discourage avian predation at the project, with an overview of the effectiveness of the activities in discouraging avian predation. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-TN on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance. Project biologists should be present to provide technical guidance at all project activities that may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering and fish handling plans. **When the river temperatures reach 70 degrees Fahrenheit or greater, all adult fish handling will be coordinated through CENWW-OD-TN.** Dewatering and fish handling plans were reviewed and revised in 1997 to ensure that they comply with Appendix F, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities that require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to March 31. During the fish passage season, parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation that prevents the facilities from operating according to criteria or which will impact fish passage and/or survival. Maintenance of facilities such as fish screens, which sometimes break down during the fish passage season, will be carried out as described below. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA (through the FPC) and NMFS on a case-by-case basis by CENWW-OD-TN. CENWW-OD-TN will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Operations Manager has the authority to initiate work prior to notifying CENWW-OD-TN when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWW-OD-TN includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage and proposed measures to mitigate them.

3.1.2.1. Extended-Length Submersible Bar Screens (ESBS). The ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning ESBS or VBS, or without a full compliment of ESBSs, flow vanes, and VBSs. If a screen fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully

screened unit. If all screened turbine units are in service, water may be spilled until the affected screen can be removed and repaired or replaced.

3.1.2.2. Vertical Barrier Screen (VBS) Cleaning. The ESBSs deflect fish and water up the gatewell slots as part of the fish collection process. Each gatewell has a VBS located vertically between the bulkhead slot and the operating gate slot. The VBSs keep guided juvenile and adult fish from passing through the bulkhead slot into the operating gate slot where the fish can pass back into the turbine intake. The VBSs are designed to distribute the flow evenly through the screens to minimize fish impingement and descaling. The water surface elevations in the gatewells are routinely measured to determine head differential across the VBSs caused by debris plugging the VBSs. VBSs are to be pulled and cleaned when head differentials reach 1.5'. Prior to pulling a VBS for cleaning, the turbine unit loading will be lowered to the lower end of the 1% turbine efficiency range and the gatewell dipped with a gatewell basket to remove all fish present in the gatewell unless doing so results in increased mortality (e.g. high numbers of adult or juvenile shad in gatewells). Immediately after dipping, the VBS shall be raised and impinged debris hosed off. The turbine unit shall remain operating at the lower end of the 1% turbine efficiency range while the VBS is being cleaned so gatewell flow will carry the debris into the operating gatewell, where it will pass through the turbine unit. Immediately after cleaning the VBS, the VBS shall be lowered to the normal operating position to prevent fish passage from the bulkhead slot into the operating gate slot. The VBSs shall not be raised longer than 30 minutes with the turbine unit running. If VBSs can not be cleaned within one work day of the head differential reaching 1.5', the turbine unit loading will be lowered to the lower end of the 1% turbine efficiency range until the VBS can be cleaned. If the cleaning frequency of VBSs exceeds project personnel’s cleaning capability of approximately 10 VBSs per day, 7 days per week, project personnel will notify CENWW-OD-TN. Then CENWW-OD-TN will coordinate with NMFS regarding an exemption to dipping gatewells prior to cleaning VBSs. An exemption to dipping gatewells prior to cleaning VBSs will be based on fish numbers and TDG levels. If a VBS is found to be damaged during an inspection or cleaning, the VBS panel will be repaired or replaced with a spare panel. The turbine unit will not be operated with a known damaged VBS.

3.1.2.3. Gatewell Orifices. Each gatewell has two orifices with valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell (normally the south orifice) is operated. If an orifice becomes blocked with debris or is

damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If there is a major failure with the bypass system that prevents the gatewell orifices from operating, traveling screens and bar screens will remain in operation. Turbine units shall not be operated with blocked or closed orifices for longer than 10 hours. During any orifice closure, project personnel shall monitor gatewells for signs of fish problems or mortality. If repairs are expected to take longer than two days, a salvage program will be initiated to dip the juveniles from the gatewells with a gatewell basket until repairs are made and the system watered up again or orifices opened. Juvenile fish shall not remain in gatewells longer than 48 hours. During periods of high fish passage, it may be necessary to cease operation of turbine units with ESBSs in place and with closed orifices in less than 10 hours, depending on fish numbers and condition. Spill may occur to provide an alternate avenue for fish passage during facility outages.

3.1.2.4. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the bypass pipe/flume. An inclined screen and a side dewatering screen allow excess water to be bled off, with all fish and remaining water transitioning into the bypass pipe. Some of the excess water is discharged into the adult fish facility auxiliary water supply system and some is used as the water supply for the transportation facilities. The dewatering structure contains trash sweeps and an air-burst system for cleaning the dewatering screens of impinged debris. If a trash sweep breaks and interferes with juvenile fish passage through the structure or if a screen is damaged, an emergency bypass system in the collection channel may be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upstream end of the inclined screen. The emergency bypass is then opened and the bypass system operated with one orifice per gatewell open. Spill may also be required to bypass juvenile fish while in emergency bypass operations. Prior to any emergency dewatering of the collection channel, CENWW-OD-TN will be notified. Then CENWW-OD-TN will be responsible for notifying NMFS and FPC of the action and coordinating changes in spill or other project operations.

3.1.2.5. Bypass Pipe/Flume. The bypass pipe/corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project through the primary bypass pipe. If there is a problem with the flume that

interferes with its operation, the emergency bypass system in the collection system can be opened and all of the fish in the bypass system diverted into the ice and trash sluiceway and passed to the river through the north powerhouse ice and trash sluiceway exit.

3.1.2.6. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to separate fish by species (based on fish size), enumerate the fish through the sampling system, and bypass part or all of the fish back to the river (secondary bypass). If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the switch gate in the bypass flume will be used to bypass fish directly to the river until repairs can be made (primary bypass).

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that will not affect fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to the normal operating criteria, unless otherwise coordinated with the fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that will significantly affect the operation of a facility will be coordinated with the CBFWA (through the FPC) and NMFS. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season, and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project so there will be less impact of it being unwatered or taken out of service. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain tilting weirs, fixed weirs, counting stations with picket

leads, and fish exits with trash racks. If any part of the fish ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picket leads, tilting weir mechanisms, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fish agencies and tribes.

3.2.2.2. North Shore Auxiliary Water Supply System. The auxiliary water for the north shore fish ladder is provided by gravity-flow from the forebay. The water passes either through a turbine unit or through a bypass system. The turbine/bypass system is operated by North Wasco County PUD. During normal operations, when the turbine unit is operating, water passes through conduits 3 and 4 to the turbine unit. From the turbine unit, the water discharges into an open pool where it feeds into ladder diffusers. If there are problems with the turbine unit, automatic valves close and the auxiliary water is diverted through conduits 1 and 3A to the baffled bypass system within the old fish lock, where the hydraulic head is dissipated and the water discharged into the diffuser pool.

3.2.2.3. South Shore Auxiliary Water Supply System. The south shore auxiliary water is made up of a combination of gravity flow from the forebay and pumped water from the tailrace. The gravity flow supplies the diffusers above weir 253 (diffusers 7 through 14) and the pumps supply the diffusers below weir 253 (diffusers 1 through 7 and the main unit diffusers). Diffuser 7 is where both systems meet and is supplied by either gravity flow or pumped flow. The gravity flow diffusers are regulated by rotovalves and the pumped flow diffusers by sluice gates. If a rotovalve fails, the nearest closed rotovalve will be opened to supply the flow. If more rotovalves fail than there are closed valves the sluice gates in diffusers 3 through 7 will be opened more to provide the required transportation flows. If any sluice gates fail, the sluice gates nearest it will be opened further to make up the water. If one pump fails, the other two pumps will be operated to maintain the facilities within criteria. If two pumps fail, SFE2 and NFE3 will be closed and SFE1 and NFE2 will be operated as deep as possible to maintain the 1' to 2' head differential. If all three pumps fail and the outage is expected to last six days or longer, the powerhouse transportation channel will be bulkheaded off at the junction pool and SFE1 and SFE2 operated a deep as possible and to maintain the 1' to 2' head differential. If a depth of 6' on both gates cannot be maintained, SFE2 will be closed. If all three pumps fail and the

outage is expected to last five days or less, CENWW-OD-TN will be notified and in turn will coordinate with the NMFS and FPC. If the gravity flow and pumped auxiliary water supply systems both fail, the powerhouse transportation channel will be bulkheaded off at the junction pool, SFE2 closed, and SFE1 operated at 6' below tailwater until repairs can be made.

3.2.2.4. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which are designed to regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure, which prevents the entrance from being operated manually, the entrance may be lowered down and left in an operating position or an alternate entrance opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and replaced with a spare floating orifice.

3.2.2.5. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done by either dewatering the fish passageway and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. Diffuser gratings may come loose during the fish passage season due to a variety of reasons. Daily inspections of fish ladders and collection systems should include looking for any flow changes that may indicate problems with diffuser gratings. If a diffuser grating is known to or suspected of having moved, creating an opening into a diffuser chamber, efforts must immediately be taken to correct the situation and minimize impacts on adult fish in the fishway. Coordination of the problems should begin immediately through the established unscheduled maintenance coordination procedure (see paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units

will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During this time period, turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3 through 10 (in any order), and then 11 through 14 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. If the project is bypassing juvenile fish back to the river through the juvenile release pipe, turbine units 1 through 4 shall be operated first (if available for operation) to provide positive downstream flows at the outfall. During the summer, (when all collected fish are transported) turbine operating priority may change to north powerhouse loading if warm water temperatures result in increased juvenile fish mortality or if project temperature monitoring indicates a temperature gradient exists across the powerhouse. Under north powerhouse loading, turbine units shall be loaded consecutively from unit 14 back towards unit 1. Turbine units 1, 2, and 3 may also be taken off-line during parts of the summer to avoid adding warmer water to the juvenile fish collection channel. Starting and stopping of units should be avoided if possible during periods of warm water, especially between 1000 and 2400 hours.

Turbine units will be operated within 1% of best efficiency from March 15 through October 31 (or as specified in BPA's load shaping guidelines, Appendix C) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines or 2) be in compliance with other coordinated fish measures. Project personnel shall record when turbine units are operated outside the 1% turbine efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between November 1 and March 15, turbine units will continue to be operated within the 1% efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within the 1% efficiency range at various heads are listed in Table MCN-4.

Table MCN-4. Turbine unit operating range with extended-length submersible bar screens installed for 1% best efficiency, McNary Dam.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
67	37.5	7,934	56.7	11,997
68	38.0	7,911	58.2	12,121
69	38.5	7,887	59.7	12,240
70	39.0	7,864	61.2	12,355
71	39.6	7,874	62.1	12,355
72	40.2	7,883	62.8	12,298
73	40.9	7,892	63.4	12,242
74	41.5	7,901	64.1	12,188
75	42.2	7,909	65.8	12,350
76	42.8	7,907	66.4	12,282
77	43.4	7,905	67.1	12,216
78	44.0	7,903	67.7	12,151
79	44.6	7,900	68.3	12,088
80	45.2	7,897	68.9	12,026
81	45.9	7,893	70.0	12,039
82	46.5	7,889	71.1	12,050
83	47.2	7,884	72.2	12,061

Note: The turbine efficiency table was revised in June 1999 to reflect new information regarding ESBSs using the 1998 index test and 1955 Prototype Hill Curve. This table contains the best information currently available.

Table MCN-4.1. Turbine unit operating range without extended-length submersible bar screens installed for 1% best efficiency, McNary Dam.

Head (Feet)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
67	37.7	7,739	57.9	11,887
68	38.2	7,716	59.4	12,009
69	38.7	7,694	60.9	12,128
70	39.2	7,671	62.5	12,243
71	39.8	7,681	63.4	12,243
72	40.0	7,691	64.4	12,242
73	41.1	7,699	65.3	12,241
74	41.7	7,708	66.3	12,240
75	42.4	7,716	67.2	12,239
76	43.0	7,714	67.9	12,172
77	43.6	7,713	68.5	12,107
78	44.2	7,711	69.1	12,043
79	44.8	7,709	69.7	11,980
80	45.5	7,706	70.3	11,920
81	46.1	7,720	71.5	11,961
82	46.8	7,734	72.6	12,000
83	47.4	7,747	73.7	12,038

Note: The turbine efficiency table was revised to reflect new information using the 1998 index test and 1955 Prototype Hill Curve. This table contains the best information currently available.

4.2. Turbine Unit Maintenance. The project turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late December time frame. The maintenance of priority units for adult passage is normally conducted in mid-August or November and December, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside

of the one percent best efficiency range. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish.

Turbine units at McNary Dam are to be operated with raised operating gates to improve fish passage conditions when ESBSs are installed. To facilitate annual maintenance, operating gates are used to unwater the turbine units. To minimize turbine outage periods to the actual time required for maintenance (during the August 1 through December 15 time period), operating gates may be lowered to the standard operating position and connected to hydraulic cylinders on the afternoon of the last regular work day (normally Thursday) prior to the start of the maintenance. With the operating gate in the standard operating position, turbine units may be operated until 0700 hours of the next regular work day (normally Monday) with generation loads restricted to 60 MWs or less. On the completion of maintenance, the turbine unit can be operated with the operating gates in the standard operating position at 60 MWs or less until the 0700 hours of the first regular work day after the maintenance is completed. The project biologist will be notified when the operating gates are set in the standard operating position. The gatewells will be monitored 2 times per day to observe fish condition while the operating gates are in the standard operating position. If turbine maintenance or the raising of the operating gates to the raised operating position is delayed after the time periods stated above, the turbine unit shall be immediately taken out of service until the work can be accomplished. Operation of turbine units with operating gates in the standard operating position shall be restricted to the August 1 through December 15 time period, and shall not begin until juvenile fish collection numbers drop to less than 10,000 fish per day. No more than 2 turbine units at a time shall be operated with operating gates in the standard operating position and the turbine units will be operated on last on, first off operating priority.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. If a turbine unit is out of service for maintenance for an extended period of time without tailrace stoplogs in place, efforts should be made to not open the wicket gates if the scroll case must be dewatered at a later date without the unit being spun before hand.

5. Forebay Debris Removal. Debris at projects can impact fish passage conditions. Debris can plug or block trashracks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. Debris can be removed from the forebay by: physically encircling the debris with log booms and pulling it to shore with boats where it can be removed with a crane, removing the debris from the top of the dam using a crane and scoop, or passing the debris through the spillway with special powerhouse operations and spill. The preferred option is to remove debris at each project when possible to avoid passing debris on to the next project downstream. This is not always possible at each project as some projects do not have forebay debris removal capability. In this case, the only viable alternative is to spill to pass the debris.

All special spills (other than normal spill patterns for ongoing spill operations) and project operations for passing debris will be coordinated prior to the operations taking place. Each project shall contact CENWW-OD-TN at least two work days prior to the day they want the special project operations for spilling to pass debris. Then CENWW-OD-TN shall coordinate the special operations with Reservoir Control Center (RCC) and NMFS. Project personnel shall provide CENWW-OD-TN the reason for the debris spill request including an explanation of project facilities being impacted by the debris, the date and time of the requested spill, and any special powerhouse or other operations required to move the debris to the spillway. When a debris spill is coordinated and approved, RCC shall issue a teletype detailing the specifics of the special operations.

Table MCN-5. McNary Dam spill pattern for fish passage.
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																					Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
3.9																			2				**2**
7.9																			2	2			**4**
9.5																			2.5	2.5			**5**
11.8																		2	2	2			**6**
13.5																		2	2.5	2.5			**7**
15.7																	2	2	2	2			**8**
17.4																	2	2.5	2.5	2			**9**
19.7															2		2	2	2	2			**10**
21.3															2		2	2.5	2.5	2			**11**
23.6													2		2		2	2	2	2			**12**
25.3													2		2		2	2.5	2.5	2			**13**
27.6											2		2		2		2	2	2	2			**14**
29.2											2		2		2		2	2.5	2.5	2			**15**
31.5									2		2		2		2		2	2	2	2			**16**
33.1									2		2		2		2		2	2.5	2.5	2			**17**
35.4									2		2		2		2	2	2	2	2	2			**18**
37.1									2		2		2		2	2	2.5	2	2.5	2			**19**
39.4							2		2		2		2		2	2	2	2	2	2			**20**
41.0							2		2		2		2		2	2	2.5	2	2.5	2			**21**
43.3					2		2		2		2		2		2	2	2	2	2	2			**22**
44.9					2		2		2		2		2		2	2	2.5	2	2.5	2			**23**
47.2					2		2		2		2		2	2	2	2	2	2	2	2			**24**
48.9					2		2		2		2		2	2	2	2.5	2	2.5	2	2			**25**
51.2					2		2		2		2		2	2	2	2	2	2	2	2	2		**26**
52.8					2		2		2		2		2	2	2	2.5	2	2.5	2	2	2		**27**
55.1					2		2		2		2		2	2	2	2	2	2	2	2	2	2	**28**
56.8					2		2		2		2		2	2	2	2.5	2	2.5	2	2	2	2	**29**
59.0					2		2		2		2	2	2	2	2	2	2	2	2	2	2	2	**30**
60.7					2		2		2		2	2	2	2	2	2.5	2	2.5	2	2	2	2	**31**
62.3					2		2		2		2	2	2	2.5	2	2.5	2	2.5	2	2.5	2	2	**32**
64.0					2		2		2		2	2	2	2.5	2	2.5	2.5	2.5	2	2.5	2.5	2	**33**
65.6					2		2		2		2	2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	**34**
67.3					2		2		2		2	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**35**
68.9					2		2		2		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**36**
70.6					2		2		2		2.5	2.5	2.5	2.5	2.5	3	2.5	3	2.5	2.5	2.5	2.5	**37**

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																					Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
71.9	2	3.5	3.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2						**37**
73.5	2	3.5	3.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2						**38**
75.2	2.5	3.5	3.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2						**39**
76.8	2.5	4	4	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2						**40**
78.5	2.5	4	4	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2						**41**
80.1	2.5	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2						**42**
81.7	2.5	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2						**43**
83.3	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2						**44**
85.6	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2					**45**
87.3	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2	2					**46**
88.9	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2					**47**
90.6	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2					**48**
92.8	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	2	2	2	2				**49**
94.5	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2	2				**50**
96.1	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2				**51**
98.4	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2	2	2	2			**52**
100.1	2.5	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2	2.5	2			**53**
101.7	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2			**54**
103.4	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2			**55**
105.7	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2	2.5	2	2		**56**
107.3	3	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		**57**
109.0	3	5	5	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		**58**
110.6	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2		**59**
112.3	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		**60**
114.5	3	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	2	**61**
116.2	3.5	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2	**62**
117.8	3.5	5	5	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**63**
119.5	3.5	5	5	3	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**64**
121.1	3.5	5	5	3	3	3	3	3	3	3	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**65**
122.8	3.5	5	5	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**66**
124.4	3.5	5	5	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	**67**
126.0	3.5	6	6	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	**68**
127.6	4	6	6	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	2.5	2.5	**69**
129.3	4	6	6	3	3	3	3	3	3	3	3	3	3	2.5	3	2.5	3	2.5	3	2.5	2.5	2.5	**70**
130.9	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	3	2.5	2.5	2.5	**71**

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																					Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
132.6	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2.5	2.5	**72**
134.2	4	6	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	**73**
135.9	4	6	6	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	**74**
137.6	4	6	6	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	**75**
139.2	4	6	6	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	**76**
140.7	4.5	7	7	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	**77**
142.4	4.5	7	7	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	3	3	**78**
144.0	4.5	7	7	3.5	3.5	3.5	3	3.5	3	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	**79**
145.7	4.5	7	7	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	**80**
147.4	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	3	3	3	3	**81**
149.0	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	3	3	3	3	3	3	**82**
150.7	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	3	3	**83**
152.3	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3.5	3	3.5	3	3	**84**
154.0	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	**85**
155.6	4.5	7	7	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	**86**
157.2	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3	3	**87**
158.9	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	**88**
160.6	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5	4	3.5	3.5	3.5	3.5	**89**
162.2	4.5	8	8	4	3.5	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4	3.5	4	3.5	4	3.5	4	3.5	3.5	**90**
163.9	4.5	8	8	4	3.5	4	3.5	3.5	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	3.5	**91**
165.5	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	**92**
167.2	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	3.5	4	4	4	4	4	3.5	4	**93**
168.8	4.5	8	8	4	3.5	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4	4	4	3.5	4	**94**
170.5	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4	4	4	4	4	4	4	**95**
172.1	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4	4.5	4	4	4	4	**96**
173.7	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4.5	4.5	4.5	4	4	4	**97**
175.3	4.5	8	8	4	3.5	4	3.5	4	3.5	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	**98**
176.9	5	8	8	4	3.5	4	3.5	4	4	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	**99**
178.5	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4	4	**100**
180.1	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4	**101**
181.7	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	**102**
183.3	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	4.5	4.5	4.5	4.5	**103**
184.9	5	8	8	4	3.5	4	3.5	4	4	4.5	4	4.5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	4.5	**104**
186.6	5	8	8	4	4	4	4	4	4	4.5	4	4.5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	4.5	**105**
188.2	5	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	4.5	5	5	5	4.5	5	4.5	4.5	**106**

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																					Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
189.8	6	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	4.5	5	5	5	4.5	5	4.5	4.5	**107**
191.4	6	8	8	4	4	4	4	4.5	4	4.5	4	4.5	4.5	5	5	5	5	5	5	5	4.5	4.5	**108**
193.0	6	8	8	4	4	4	4	4.5	4	4.5	4.5	4.5	4.5	5	5	5	5	5	5	5	5	4.5	**109**
194.6	6	8	8	4.5	4	4.5	4	4.5	4	4.5	4.5	4.5	4.5	5	5	5	5	5	5	5	5	4.5	**110**
196.2	6	8	8	4.5	4	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	**111**
197.8	6	8	8	4.5	4	4.5	4.5	4.5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	**112**
199.3	6	8	8	4.5	4.5	4.5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	**113**
200.9	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	4.5	**114**
202.5	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	5	5	5	5	5	5	**115**
204.1	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	5	5	6	5	5	5	5	5	**116**
207.3	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	5	5	6	5	6	5	6	5	5	5	**118**
210.5	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	6	5	6	5	6	5	6	5	6	5	**120**
213.7	6	8	8	5	4.5	5	4.5	5	4.5	5	4.5	5	6	5	6	6	6	6	6	5	6	5	**122**
216.9	6	8	8	5	5	5	5	5	5	5	5	5	6	5	6	6	6	6	6	5	6	5	**124**
220.1	7	9	8	5	5	5	5	5	5	5	5	5	6	5	6	6	6	6	6	5	6	5	**126**
223.3	7	9	8	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	5	**128**
226.5	7	9	8	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	**130**
229.7	7	9	8	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	**132**
232.9	7	9	8	5	5	5	5	5	5	6	6	6	6	6	7	6	6	7	6	6	6	6	**134**
236.1	7	9	8	5	5	5	5	5	5	6	6	6	6	6	7	7	6	7	7	6	6	6	**136**
239.3	7	9	8	5	5	5	5	5	5	6	6	6	6	7	7	7	7	7	7	6	6	6	**138**
242.5	7	9	8	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	7	6	6	6	**140**
245.8	7	9	8	5	5	5	5	6	6	6	6	6	6	7	7	7	8	7	7	7	6	6	**142**
249.0	7	9	8	5	5	5	5	6	6	6	6	6	6	7	8	7	8	7	8	7	6	6	**144**
252.2	7	9	8	5	5	5	5	6	6	7	6	7	6	7	8	7	8	7	8	7	6	6	**146**
255.4	7	9	8	6	5	6	5	6	6	7	6	7	6	7	8	7	8	7	8	7	6	6	**148**
258.6	7	9	8	6	5	6	5	6	6	7	6	7	7	7	8	7	8	7	8	7	7	6	**150**
261.9	7	9	8	6	5	6	5	6	6	7	6	7	8	7	8	7	8	7	8	7	7	7	**152**
265.1	7	9	8	6	6	6	6	6	6	7	6	7	8	7	8	7	8	7	8	7	7	7	**154**
268.3	7	9	8	6	6	6	6	6	6	7	7	7	8	7	8	8	8	7	8	7	7	7	**156**
271.6	7	9	8	6	6	6	6	6	6	7	7	7	8	8	8	8	8	8	8	7	7	7	**158**
274.8	7	9	8	6	6	6	6	6	6	7	7	8	8	8	8	8	8	8	8	8	7	7	**160**
278.0	7	9	8	6	6	7	6	6	7	7	7	8	8	8	8	8	8	8	8	8	7	7	**162**
281.3	7	9	8	6	6	7	6	6	7	7	8	8	8	8	8	8	8	8	8	8	8	7	**164**
284.5	7	9	8	7	6	7	6	7	7	7	8	8	8	8	8	8	8	8	8	8	8	7	**166**

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.

Table MCN-5. McNary Dam spill pattern for fish passage (continued).
(Discharge in kcfs at forebay elevation 339)

Spill (kcfs)	Bay																					Total Stops
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
287.7	7	9	8	7	6	7	6	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	**168**
290.9	7	9	8	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	**170**
294.2	8	9	8	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	**172**
297.5	8	9	8	7	8	7	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	**174**
300.7	8	9	8	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	**176**

*** Special care MAY be required to open and close Bays 1 & 22. (This will need to be verified by field testing.)**

Opening sequence:

a) Open Bays 2 – 21 first, as specified in the spill pattern table.

b) After Bays 2 - 21 have been set and operating for at least 10 minutes, open Bays 1 & 22 to their desired settings.

Closing Sequence:

a) Close Bays 1 & 22 prior to closing Bays 2-21.